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Abstract

Researchers have long studied the group dynamics of teams with the goal of making teams more effective. This study looks at the task structure to determine if groups are more likely to collaborate or cooperate to successfully complete a project. Initial findings indicate that the higher the structure of a project the more likely teams will gravitate to cooperation while the less structured the project the more likely teams are to work collaboratively. Initial findings indicate that the determination of the "structuredness" of a project is a subjective rather than objective assessment.

Keywords: Collaboration, Cooperation, Small Groups, Student Teams, Task Structure

Introduction

Many projects can be broken down and modularized to allow individuals to work on separate tasks while other projects require the group to work together as a whole. The business world has long focused on effective and efficient team processing which calls for groups to work together to successfully complete projects of various sizes, complexity, and structure. In education, the authors' experience has been that most instruction has focused on individual activity. Even when group projects are assigned, it is found that many teams simply divide the work so that it can be done independently with a minimum amount of collaborative activity. The question then arises, how can an instructor at the undergraduate level create projects that encourage teams to collaborate on projects? The way a task is structured may be one effective way to encourage collaboration within teams. This paper examines the impact of task structure on the use of collaboration and cooperation by small undergraduate teams to successfully complete projects in an introductory information systems course.

Background

Team work division in a problem solving context can be viewed as a continuum from competition to cooperation to collaboration. Many equate cooperation with collaboration. Roschelle et al. (1995) define collaboration as "a coordinated, synchronous activity that is the result of a continued attempt to construct and maintain a shared conception of a problem (p. 2)." Cooperation might then be defined as a form of asynchronous collaboration. Thus one can distinguish cooperation from collaboration as each team member working separately or independently from the other team members on previously defined parts of the project while in collaboration team members work together.

The literature makes little discrimination between the terms cooperation and collaboration. Research describes the following characteristics as determinants of this combined cooperation-collaboration concept. In a study of collaboration between parents of disabled children and service providers, Blue-Banning et al. (2004) found six themes necessary to producing collaboration:

Communication, Commitment, Equality, Skills, Trust, and Respect. In the business world, Amabile et al. (2001) found three categories of team and team member characteristics that appear to predict collaborative success: (1) project-relevant skill and knowledge, (2) collaboration skill, and (3) attitudes and motivation. “The most important features of project-relevant skills and knowledge appear to be diversity and complementarity in the skills, perspectives and knowledge of team members, paired with a common core of understanding about the problem domain; the existence of this constellation of presumably depends on an appropriate selection of collaborators (p. 419).” Collaboration skill appears to stem from experience with collaborative relationships. “The most important attitude appears to be trust. Other attitudes include: Intrinsic interest, openness to change, different people and new ideas. Equality of stakes in outcomes. Understanding of cultural differences (p. 419).”

Task structure also has an effect on the propensity to collaborate. Chizhik et al. (2003) defined well-structured tasks as “...activities with a clearly specified problem and only one possible solution.” They defined ill-structured tasks as possessing “multiple possible solutions that can be evaluated subjectively as good or poor”. They further point out that “well-structured tasks may make it easier for participants to distinguish correct from incorrect solutions such that they value the correct solution and the abilities necessary to find that solution; this situation contributes to a task orientation on the part of the group. Ill-structured tasks may make it easier for group members to consider each other's suggestions and encourage participation from all group members; this situation strengthens the group's collective orientation.” (Chizhik et al. 2003).

Van De Ven et al. (1976), found that task uncertainty, defined as “the difficulty and variability of the work undertaken by an organizational unit (p. 324)”, to be positively associated with a greater use of personal coordination mode and a greater use of group coordination. They go on to describe the determinants of “coordinating modes” as task uncertainty, task independence and unit size. They split task uncertainty into two parts: task difficulty (analyzability, complexity of solution processes, level of effort required to solve the problems) and task variability (sameness of work, variety/repetitiveness of methods, number of work exceptions). Task interdependence they defined as the extent to which the team members are dependent upon each other (Van De Ven et al. 1976).

Related research has been done in the area of problem-based learning, which is a student centered approach to teaching that was originally developed for medical education in the 1970's (Savery 1995). In the past decade there has been an increased adoption of the practice within the medical field and in other professional disciplines such as architecture, law, and business (Camp 1996). In a problem-based learning environment, it is expected that students will benefit from the deeper thought processes that are called on during problem solving situations. Authenticity of problems that are complex and unstructured is a key factor because it promotes higher level thinking activities such as conjecture, argumentation, and collaboration (Kolodner 1996). Although proponents of problem-based learning have been very vocal in promoting its benefits, more recent reviews of the evidence question its comparative advantage over conventional curricula (Norman 2000). This study extends the work in problem-based learning by focusing on the cooperative and collaborative aspects of team interaction during project activity. In this study, a low degree of task structure is hypothesized to promote collaborative activity that involves critical thinking as team members engage in a problem solving dialogue.

Research Question

In the business education environment, it is of interest to teach students to work together in teams. This is viewed as an essential skill for success in the business environment. Educating students to work in teams starts at the beginning of their academic careers in the entry-level courses with required group projects.

Educators would like to encourage students to not merely cooperate, but collaborate in completing projects. Given that the literature is relatively sparse in defining the determinants of collaboration, this study was designed to be a first step in a program of research to identify methods to encourage students to collaborate on projects. Beyond the determinants of collaboration described above, the authors selected project structure as a construct on which to focus.

Project structure was defined in a manner similar to Amabile, et al (2001), using the “definedness” or lack of scope for interpretation of the requirements of a task to establish the level of task structuredness.

Thus the research question was stated as:

To what extent does task structure affect the propensity of teams to collaborate vs. cooperate?

By propensity, the authors mean the tendency or natural inclination toward a course of action. Hence, this study asks if the structure of a task affects the inclination of teams to work together as a committee of the whole as opposed to working on predetermine parts as individuals. The authors hypothesize that in well-structured projects, teams would be more likely to work cooperatively. In poorly structured tasks, it is hypothesized that teams will be more likely to collaborate in an attempt to

complete the project successfully. It is expected that in well structured projects, more time would be spent working individually while in poorly structured projects more time would be spent working together in a group.

As no prior studies were found that had performed this analysis in an undergraduate environment, two team projects were examined within an existing course. As in most universities, the predominant instructional style within the author's university is lecture with individual study and group projects. While in group projects, the students already cooperated, it was anticipated that if the project structure was varied so that tasks because less "defined" and more open to interpretation, that the level of collaboration would increase.

Procedure

The authors used a positivist, quantitative approach for this study. The time spent collaborating/cooperating was assessed by the collection and analysis of self-reported time spent in these activities.

The pilot study took place in a Business School at a large urban university in the southern United States. The Business School requires an Introduction to Computer-Based Information Systems course for students from all departments and can be used as an elective by members outside of the college. Two sections of the course were examined with an enrollment of 60 undergraduate students and 58 students completing all parts of the study. Demographically, the students had an average age of 22.5, and were taking 12.6 semester credit hours and had 22.3 hours committed to employment during the week. In one class, groups were assigned by the instructor ensuring a mix of gender, race, and class rank. The other class allowed self-selection of team composition resulting in 54.5% single gender groups.

Students enrolled in this course were required to complete two major group projects. The first project, performed in teams of three students, was to develop a small database system using Microsoft Access. This project was highly structured in that the deliverables were closely defined in terms of structure of the database, input and output formats. Processes were identified including normalization, importing, creating primary keys, modifying properties and establishing relationships. Deliverables were also identified and included queries, forms, and reports.

The second project was much less structured. In teams of two, the students selected a topic and produced at least a four-page research paper and a five-minute PowerPoint assisted presentation. For this project, the deliverables were loosely defined leaving much open to determination by the students. The students select a topic from a list provided by the instructor. The paper's format was prescribed in terms of content and citations. The remainder of the paper was at the students' discretion.

In addition to the deliverables, the students completed a journal of their team's activities during the two project periods. In their individual journals, students recorded the meetings and interactions that they had during the project. Each student recorded the date, start time, stop time, location, attendees, events and issues. A sample of journal entries is included in Appendix 1. The contents of the journal were not graded.

Given that these were team projects with a single deliverable to be submitted by each individual, it was necessary for teams to either collaborate or cooperate to complete the project. It was anticipated that their initial time would be spent collaboratively to establish roles, exchange e-mail addresses and phone numbers. This collaboration at the beginning of the project would then be followed by either periods of collective activity indicative of collaboration or individual activity indicative of cooperation.

To assess the levels of cooperation and collaboration that occurred during the projects, the authors operationalized collaboration time as time spent working together and cooperation as time spent working independently. The propensity to collaborate would be assessed by a ratio of the time spent collaborating versus time spent cooperating. An analysis was conducted on the amount of time and type of interactions found in the journals submitted by the students.

The individual journals of each team member were consolidated into a team journal. Each line showing cooperative activity (only the student had been working) was recorded. For each line of collaborative activity (multiple team members working together), a single entry for activity was retained in the journal. Where times reported by the students differed, if two reported the same times, those times were accepted as accurate. Where no time matches occurred, the longest amount of time was accepted. The total amount of time spent collaborating and cooperating was then entered into a summary analysis sheet. The average of total time and the corresponding standard deviation were computed. Those consolidated team entries with total time and number of lines varying by more than one standard deviation toward zero were eliminated as possessing insufficient data. The eliminated teams were deemed to have failed to properly report their time.

Findings

Data from the first "structured" project provided responses from 58 students in 21 teams of three. After reviewing the data, 19 teams were identified as valid for analysis. The teams on average used 1,108 minutes to complete the task and reported 15 lines in their consolidated journals. The percentage of time allocated to cooperation and collaboration was then derived. Preliminary results show that on average 673 minutes (60.6%) was allocated to cooperative activities with 437 minutes (39.4%) in collaborative activities.

The second "unstructured" project included 61 students in 30 teams of two (there was one team of three). After reviewing the data, 19 teams were identified as valid for analysis. These teams on average used 1,217 minutes to complete the task and reported 15 lines in their consolidated journals. They reported on average 869 minutes (72%) was allocated to cooperation with 349 minutes (28%) allocated to collaboration activities.

Discussion and Conclusion

The findings are contradictory to the hypothesis formed after the literature review. The authors anticipated much higher levels of collaboration on the "unstructured" project. On further analysis, it was recognized that the authors defined what was "structured" versus "unstructured." In fact, in observation of one class, more expressions of difficulty and uncertainty came from the students related to the project considered "structured" rather than the one considered "unstructured." The authors hypothesize therefore that "structuredness" is subjective for each team. What may appear structured to students may in fact appear "unstructured" to the team members. The revised experimental model now appears as in figure 1.

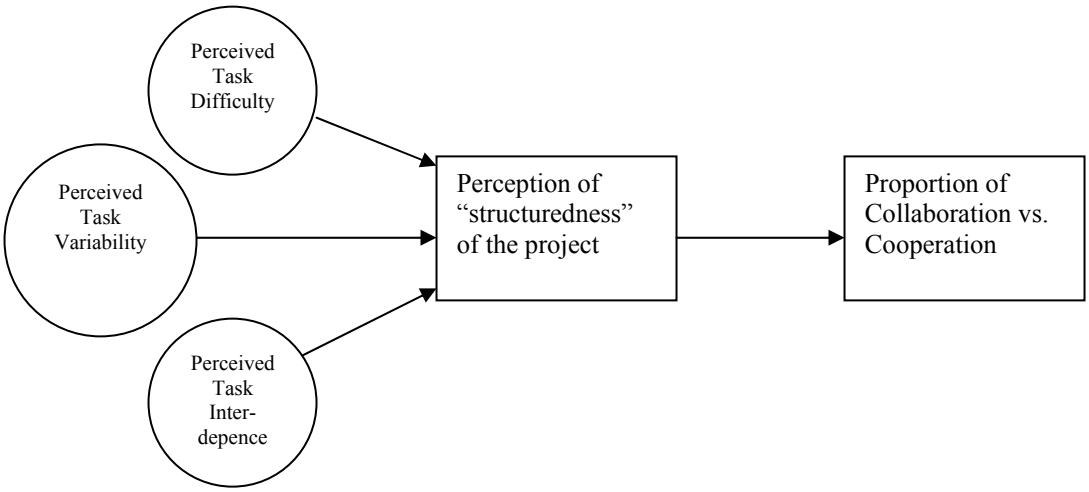

Figure 1: Experimental Model

In the next round of this study, the authors will poll the students' perception of the "structuredness" of the projects in addition to collecting their time journals. Questions have been added to the post project surveys to measure that determinants of task structure as described by (Van De Ven et al. 1976). These questions will measure the degree of task difficulty, variability and interdependence related to each project as perceived by the students. The questions are listed in Appendix 2.

Following the collection of data, these questions will be subjected to reliability analysis including calculation of Cronbach's Alpha. The individual questions will then be aggregated into single measures of difficulty, variability and interdependence. The aggregated measures will then be used in a multi-variate regression to determine the correlation of these items with the amount of time spent in collaboration.

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Appendix 1: Example Individual Journal

My Name: RRR
Partner #1 (P1): KKK
Partner #2 (P2): SSS

Date	Started	Ended	Where?	Who was there? Me	P1	P2	What happened?	Issues?
10/19/04	9:05 AM	9:15 AM	Classroom	X	X	X	Chose project leader, Discussed assignments, Assigned tasks, …	
10/22/04	12:00PM	12:30PM	Computer Lab	X			Looked over project and began to normalize tables.	Had problems with normalization; Emailed group members for help
10/28/04	9:15AM	9:20AM	Classroom	X	X	X	Met up with group after class to get help on normalization	SSS had completed normalization and started queries
10/28/04	9:30AM	10:15AM	Computer Lab	X	X		Reviewed project and started working on reports	Me and KKK had problems getting the commission amount onto table
10/28/04	10:37AM	10:40AM	Computer Lab	X			Emailed Professor Johnson re:commission amount	
10/28/04	10:37AM	10:40AM	Computer Lab	X			Emailed SSS to let him know we were having problems with tables	
10/31/04	11:00AM	11:20AM	On phone	X	X		Spoke with KKK regarding what was left to be completed	Tables still not corrected
11/4/04	9:15AM	9:20AM	Classroom	X	X	X	Team discussed commission amount	We couldn't figure out how to calculate it.
11/4/04	9:20AM		Classroom	X	X		Asked subsitute if he had any suggestions for getting the commission amount	He was unsure of how to get it into report.
11/4/04	1:00Pm	1:03PM	On Phone	X		X	SSS called and had figured out commission amount.	All that was left to complete is last report.
11/6/04	4:00PM	4:15PM	On Phone	X	X		KKK called to have me check last report. Checked it and gave ok.	

Appendix 2: Structuredness Assessment Questions

These questions will be asked of each student at the end of each project and will be entered on a five-point likert scale.

Task Difficulty – These questions assess the analyzability of work, predictability of methods, degree of complexity of search processes, amount of thinking to solve problems, amount of time before outcomes known

1. My team easily figured out how to do this project.
2. My team knew how to do this project at the start.
3. My team did not have to spend a lot of time on the project before we knew that we would be successful.
4. My team had the skills that it needed to do this project.

Task Variability – These questions assess the sameness of work, number of work exceptions, variety of methods and repetitiveness of processes

1. This project required many different skills
2. This project required us to do the same thing many times.
3. This project required us to do many different kinds of tasks.
4. This project required us to change kinds of tasks frequently.

Task Interdependence – These questions assess the extent to which personnel are dependent upon each other

1. This project required that work be passed sequentially between team members.
2. This project required that people work together to complete it.
3. This project could have been done by any one of our team members by themselves.
4. This project allowed each team member to work independently on their part of the project.